**OCDSB Night School**

**Merivale High School**

**PRACTICE EXAM**

**Mathematics Department**

**DECEMBER Examination 2016**

**MHF4U6-04 MU**

**Grade 12 Advanced Functions**

Including this cover page, this exam has 12 pages**.**

**Date:** Tuesday, December 13, 2016

**Time:** 6:00 PM to 9:00 PM

**Teacher:** Ms. Vlug

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**SPECIAL INSTRUCTIONS**

Foolscap required: Yes (for rough work only) No

X

Scantron required: Yes No

X

X

Student Generated Fact Sheet: Yes No

**INSTRUCTIONS SPECIFIC TO THIS EXAM**

1. If you run out of room on a page, clearly indicate that you are continuing your work on a piece of foolscap and then complete your work and attach the page to the back of the exam.
2. **Graphing calculators and cell phones are not permitted.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Logarithms** | **Trigonometry** | **Polynomial / Rational** | **Characteristics** | **Final Exam Mark** |
| Level \_\_\_\_\_\_ | Level \_\_\_\_\_\_ | Level \_\_\_\_\_\_\_ | Level \_\_\_\_\_\_\_ | Level \_\_\_\_\_\_\_ |

**Overall Expectations: Advanced Functions (MHF4U)**

**By the end of this course, students will:**

**A. EXPONENTIAL AND LOGARITHMIC FUNCTIONS**

A1. Demonstrate an understanding of the relationship between exponential expressions and logarithmic expressions, evaluate logarithms, and apply the laws of logarithms to simplify numeric expressions;

A2. Identify and describe key features of the graphs of logarithmic functions, make connections among the numeric, graphical , and algebraic representations of logarithmic functions, and solve related problems graphically;

A3. Solve exponential and simple logarithmic equations in one variable algebraically, including those in problems arising from real-world applications.

**B. TRIGONOMETRIC FUNCTIONS**

B1. Demonstrate an understanding of the meaning and application of radian measure;

B2. Make connections between trigonometric ratios and the graphical and algebraic representations of the corresponding trigonometric functions and between trigonometric function and their reciprocals, and use these connections to solve problems;

B3. Solve problems involving trigonometric equations and prove trigonometric identities.

**C. POLYNOMIAL AND RATIONAL FUNCTIONS**

C1. Identify and describe some key features of polynomial functions, and make connections between the numeric, graphical, and algebraic representations of polynomial functions;

C2. Identify and describe some key features of the graphs of rational functions, and represent rational functions graphically;

C3. Solve problems involving polynomial and simple rational equations graphically and algebraically;

C4. Demonstrate an understanding of solving polynomial and simple rational inequalities.

**D. CHARACTERISTICS OF FUNCTIONS**

D1. Demonstrate an understanding of average and instantaneous rate of change, and determine numerically and graphically, and interpret the average rate of change of a function over a given interval and the instantaneous rate of change of a function at a given point;

D2. Determine functions that result from the addition, subtraction, multiplication, and division of two functions, and from the composition of two functions, describe some properties of the resulting two functions, and solve related problems;

D3. Compare the characteristics of functions, and solve problems by modeling and reasoning with functions, including problems with solutions that are not accessible by standard algebraic techniques.

**Evaluation**

This examination consists of three (4) sections – one section for each of the strands A: *Exponential and Logarithmic Functions*, B *Trigonometric Functions*, C *Polynomial and Rational Functions* and D: *Characteristics of Functions*.

Students will be evaluated in each strand on the extent to which they meet the criteria set out, with respect to the strand, for the following: Knowledge and Understanding, Thinking and Inquiry, Communication, and Application criteria listed in the rubric below.

**Students who fail to meet Level 1 in a strand will be assessed a Level R for that strand.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Categories** | **50-59%**  **(Level 1)** | **60-69%**  **(Level 2)** | **70-79%**  **(Level 3)** | **80-100%**  **(Level 4)** |
| **Knowledge and Understanding**: Content knowledge and comprehension of meaning and significance | | | | |
| **Knowledge of Content**  (facts, terms, proper procedural steps) | demonstrates  **limited knowledge**  of content | demonstrates  **some knowledge**  of content | demonstrates  **considerable**  **knowledge** of  content | demonstrates  **thorough knowledge**  of content |
| **Understanding of Mathematical Concepts**  (proper procedures used) | demonstrates **limited understanding** of concepts | demonstrates **some understanding** of concepts | demonstrates **considerable understanding** of concepts | demonstrates **thorough understanding** of concepts |
| **Thinking**: use of critical and creative thinking skills and/or processes | | | | |
| **Use of Processing Skills**  (reasonableness, justifying, proving, reflecting) | uses processing  skills with **limited**  **effectiveness** | uses processing  skills with **some**  **effectiveness** | uses processing  skills with  **considerable**  **effectiveness** | uses processing  skills with a  **high degree of**  **effectiveness** |
| **Communication**: The conveying of meaning through various forms | | | | |
| **Use of Conventions, Vocabulary, and Terminology in Visual, and Written Forms**  (units, symbols, terms) | uses conventions,  vocabulary, and  terminology of  the discipline  with **limited**  **effectiveness** | uses conventions,  vocabulary, and  terminology of  the discipline  with **some**  **effectiveness** | uses conventions,  vocabulary, and  terminology of  the discipline  with **considerable**  **effectiveness** | uses conventions,  vocabulary, and  terminology of  the discipline with  a **high degree of**  **effectiveness** |
| **Application**: Make connections between and within various contexts using knowledge and skills | | | | |
| **Application of Knowledge**  **and Skills in Familiar Contexts** | applies knowledge  and skills in familiar  contexts with **limited**  **effectiveness** | applies knowledge  and skills in familiar  contexts with **some**  **effectiveness** | applies knowledge  and skills in familiar  contexts with  **considerable**  **effectiveness** | applies knowledge  and skills in familiar  contexts with a  high **degree of**  **effectiveness** |

**Each section consists of two parts:**

* **Short Answer**
* **Extended Response**

**Short Answer**:

The final answer will be valued; however, considerations may be given to work shown.

**Extended Response**:

Students are expected and required to organize and express complete responses to each of the problems such that they demonstrate the full range of their understanding of the relevant mathematical concept(s). Students will provide logical justification for their conclusions and ideas and use representations (algebraic, numerical, and graphical) when they communicate their ideas.

Section A: Logarithmic and Exponential Functions

**Short Answer**:

1. **State** the transformations applied to  to obtain.
2. Explain the relationship between a log function and an exponential function.
3. Given log2a + log2b = 4, what are the possible values of a and b (a, b ∈ N)?
4. **Evaluate** log91200 to 3 decimal places

**Extended Response**:

1. **Solve:** to 3 decimal places.
2. A bacteria culture starts with 10 000 bacteria. After 40 minutes the count is 30 000. What is the doubling period?
3. **Solve and check** 
4. Evaluate the following logarithms to 3 decimal places. Explain the pattern in the results.

a) log 5

b) log 25

c) log 125

d) log 625

e) log 3125

Section B: Trigonometric Functions

**Short Answer**:

1. State the **exact** value of 
2. Compare the periods of the functions  and . What does this tell you about the functions?
3. Describe the key features of 
4. Solve , .
5. Write an equation to represent a periodic function with amplitude 8, period π, and with one of its maxima at (0,-5).

**Extended Response**:

1. Solve:   in the interval .
2.  and  are acute angles in quadrant I, withand . **Without** finding the size of the angles or using decimal values, determine the value of .

Section C: Polynomial and Rational Functions

**Short Answer**:

1. Determine the equation that contains the following information:

* degree 4, roots –2 and 2, -1, and -1, with a y-intercept of -3  
  (**Write final answer in factored form – do not expand**)

1. Write the equationsof **all** asymptotes and holes for the function**:**
2. Write a rational equation that cannot have 6 or -8 as solutions

**Extended Response**:

1. Fully factor the functions: , 
2. Solve the rational inequality:  
3. Solve the following polynomial: 
4. An open box is made from a rectangular piece of cardboard with dimensions 18 cm by 25 cm, by cutting congruent squares from each corner and folding up the sides. Determine all possible dimensions of the squares to be cut to create a volume less than 189 cubic cm.

Section D: Characteristics of Functions

**Short Answer**:

1. A golfer hits a ball up in the air. The height of the golf ball in metres above the ground is given by

, where *t* is the number of seconds after the ball is hit. What is the average rate of change in the height of the ball over the interval ? Does this make sense?

1. Given  and , determine the following and state the domains for each

|  |  |
| --- | --- |
| a) | b) |
| c)(f-g)(x) | d)f(g(x) |
| e) f(x)g(x) | f) |

**Extended Response**:

1. A particle moves along the y axis with the relationship  where *s(t)* represents the displacement and *t* represents the time.

a) What is the instantaneous rate of change at t = 4   
  
b) Is there a maximum, minimum, or neither at t = 4? Give reasoning.

1. Given that f(x) = -9x+3 and g(x) =, write a value for each of these

|  |  |
| --- | --- |
| a) fg(20) | b) gf(4) |
| c) | d) |
| e) | f) |